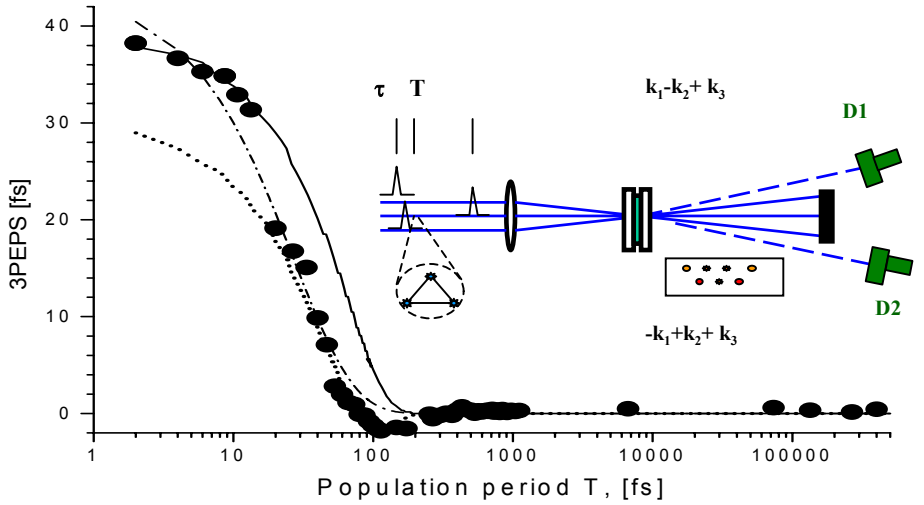
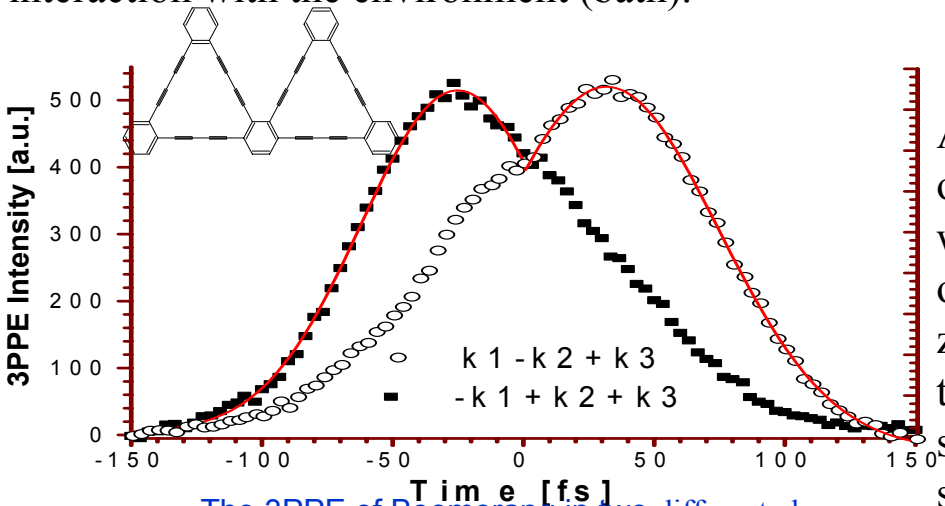
Coherent Excitations in a Novel Carbon Network Structures based on Dodecadehydrotribenzo [18] annulene

T. Goodson III, Wayne State University, DMR-0134691

A novel carbon network architecture called Dodecadehydrotribenzo [18] annulene (Boomerang) has been investigated by 3-pulse-photon-echo-peak-shift (3PEPS) measurements. Previous quantum calculations suggested the dominance of a highly delocalized π to π* transition. The 3PEPS measurements with the Boomerang (at 298K) were carried out to probe the contributions of relative broadening mechanisms and to characterize the interaction with the environment (bath).



3PEPS-data the Boomerang in toluene (solid circles). The modeling of the data using Gaussian (solid line) and damped cosine (dots) correlation function



The 3PPE of Boomerang in two different phase matching directions at population time 6.7fs.

An unusually large initial peak shift value was obtained which strongly suggests that the interaction with the bath is relatively small by comparison to other organic molecules. Also, the peak shift decays to zero with ~100 fs of population time. This suggests the contribution of inhomogeneous broadening is small after this time period. These results strongly suggest that the boomerang system may be useful for future applications involving nonlinear and quantum optical effects.

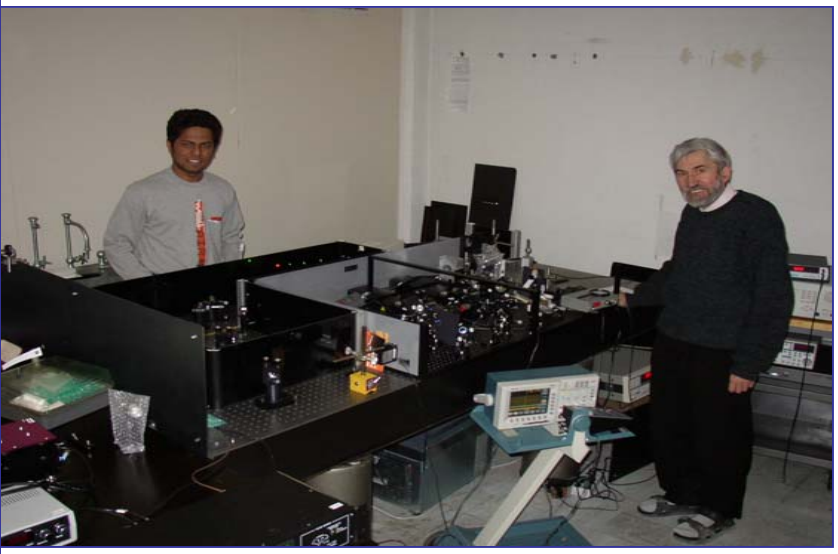
S. Lahankar, O. Varnavski, M. Haley, J. Marsden, T. Goodson III J. Amer. Chem. Soc. (submitted)

Coherent Excitations in a Novel Carbon Network Structures based on Dodecadehydrotribenzo [18] annulene

T. Goodson III, Wayne State University, DMR-0134691

Educational Aspects of Study:

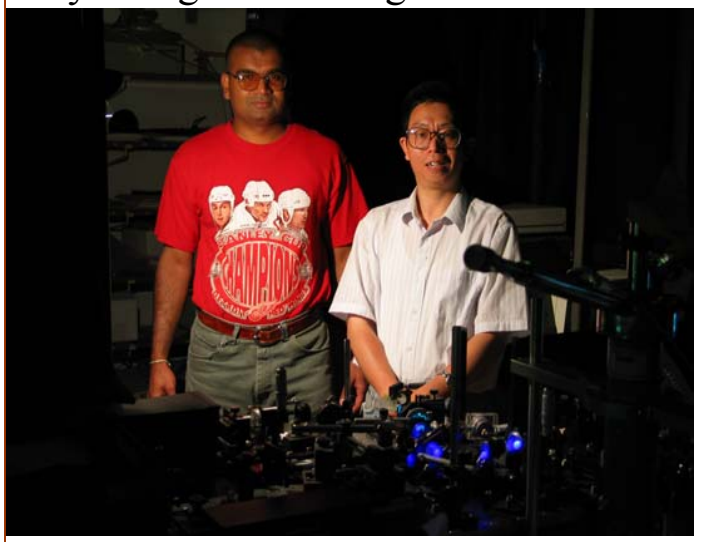
Graduate Student Sridhar Lahankar and postdoctoral fellow Oleg Varnavski have worked on this project. The annulene samples were obtained from Professor Mike Haley (U. of Oregon). The complete laser (cavity dumped oscillator) and photon echo apparatus was constructed by these two well trained scientists.



Graduate Student Sridhar Lahankar (left), and Research Associate Oleg Varnavski (right) stand before the 3-pulse-photon-echo setup.

Outreach Activities:

The PI's group participated in the project SEED (ACS) program were high School students trained under experienced graduate (Mahinda Ranasinghe) and postdoctoral (Xingzhong Yan) scientists. The high school students learned the fundamentals of steady-state and time-resolved optical techniques and presented a paper at the end of the summer. The PI also participated in the 2003 national NOBCCHE where the WSU chapter (Dr. Keith Williams is director) participated in the science competition and the PI was the recipient of the Lloyd Ferguson Young Scientist Award.



M. Ranasinghe (left) and X. Yan (right) stand before the fluorescence up-conversion unit in studies of ultra-fast photo-physics of novel organic materials.